

JOB COMPLETION REPORT
INVESTIGATIONS PROJECTS

State of Montana

Title of Job Investigations of Fish Mortality, Yellowstone River Drainage, 1955.

Objectives: To determine conditions causing mortalities and to make recommendations for control.

Techniques Used:

1. A review of the history of the fisheries in the Yellowstone River drainage was made.
2. Interviews were conducted with interested persons, professional personnel and agencies involved.
3. Fish were collected and examined at the Montana State College Fish Laboratory.
4. A general survey of the drainage with respect to weather conditions, management activities, and topography was made.
5. Food organism studies were conducted throughout the drainage.
6. Shocking was used for inventory of remaining fish population.
7. Relative literature was reviewed.

Findings: A review of the history of the fisheries in the Yellowstone River drainage revealed no record of an extensive fish mortality in this river system. This history included observations made by trained fishery personnel from the year 1935. Observations had been made of limited deaths, usually attributed to spawning. In general, the river system is noted for its high productivity and good fishing.

Through interviewing fishermen and professional management people in the area, it was found that the first observations of dead or dying fish were made during the middle of October, 1955. These observations were made all along the river system to Big Timber, Montana, a distance of approximately 91 road-miles below Gardiner, Montana. No interviews were conducted below Big Timber, Montana. Interviews of fishermen using the waters within the Yellowstone National Park, in the Gardiner area, indicated that fish had died within the boundaries of the Park.

Float trips conducted on the River during this period indicated that the species composition of the mortality was predominately whitefish, with brown trout second. A few suckers were reported. A few carp are known to exist within this drainage, but none were observed in the mortality.

During these observations a density of 600 dead fish in approximately 250 yards in the Gardiner-Emigrant area was noted. Observations also disclosed that all sizes of whitefish were dying or dead.

On November 25, 1955, during a float trip, personnel of the Emigrant Fisheries Station observed only one whitefish where on similar float trips in previous spawning seasons large schools of fish were observed.

While no dead fish counts were made outside of the above-mentioned area, it should be pointed out that the mortality was extensive and would be measured in tons of fish.

Interviews conducted with the fly and tackle industry in the drainage area revealed that the fly fishing this fall was poor, and the big complaint was that there was a definite lack of aquatic insects. The salmon fly (Plecoptera) hatch was observed to have suffered an extensive mortality.

Observations of stomachs by people engaged in fly fishing revealed that the diet of fish during the fall months was composed primarily of snails and moss, with a limited number of flying ants. This report of moss in the fishes' stomachs was also coupled with the report of excessive aquatic vegetation in the river system this fall.

An examination of dead fish made by personnel of the Fish Laboratory of the Montana State College revealed that the fish were in an emaciated condition. Examinations of the stomachs indicated a definite lack of fat, especially with respect to the pyloric caeca region. Examinations of healthy fish made during previous years indicate that this is an excellent measure of condition.

A general survey of this river system with respect to weather conditions and management activities revealed that the only activity different in this system during the year 1955 was an extensive spruce budworm control program carried on during the month of July.

Figure 1 is a map of the Yellowstone River drainage with special reference to the higher peaks within this mountainous drainage. The topography is sharp and the side drainages of the Yellowstone River vary greatly in elevation, and in many areas the canyon sides approach the perpendicular. The shaded area indicates the approximate outline of the Gardiner Spruce Budworm Control Project. This area was sprayed in July, 1955, with a one-pound-per-acre application of DDT in fuel oil. There was a total of 132,856 acres sprayed within this drainage. The black areas indicate respray areas on perpendicular slopes, or a two-pound-per-acre application for these areas. Fifty-five thousand, four hundred twelve acres of this land are within the boundary of Yellowstone National Park; 72,292 acres are National Forest land; 5,152 acres are private land. The total cost of this spruce budworm control project was \$144,082.69.

From December 7th to December 15th, 1955, random insect collections were made by collecting the aquatic forms on 20 stones per station on accessible streams throughout the drainage. Table 1 is a summary of the aquatic insect collections taken in the Yellowstone River drainage outside of Yellowstone Park. There was a noticeable absence of the aquatic forms of stoneflies, caddisflies, and mayflies. A light population of plecoptera was present in the main Yellowstone River, but very few were collected by the random sampling technique employed. During this same period, streams outside of the sprayed areas showed large numbers of mayflies, caddisflies, stoneflies, and aquatic insects. No collections were made above the sprayed area within Yellowstone National Park due to the inaccessibility of this terrain.

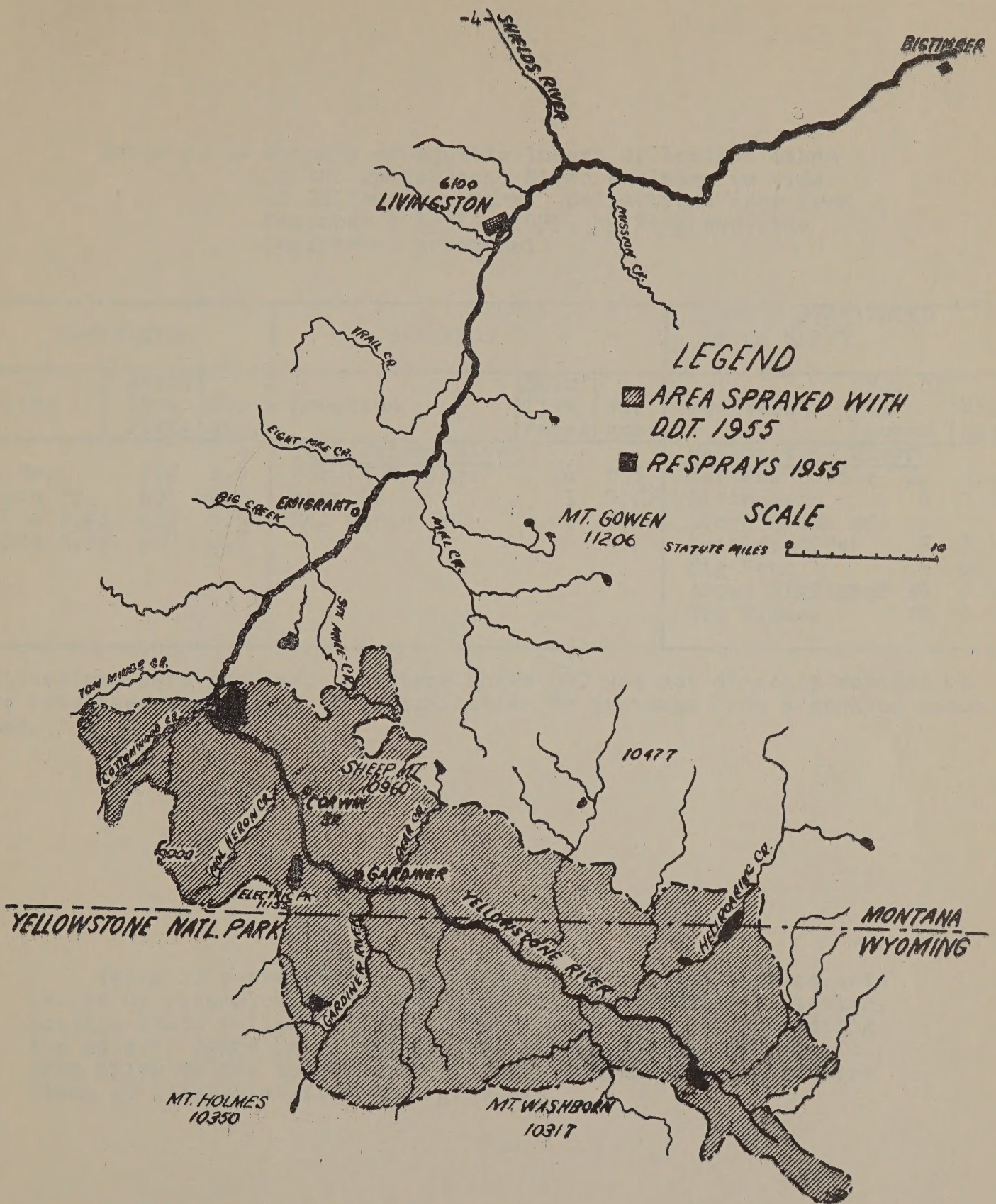


Figure 1. Area in southcentral Montana sprayed with DDT in July, 1955.

Table 1. -- Summary of aquatic insect collection taken in the Yellowstone River drainage outside of Yellowstone Park. Collections made from December 7 to 10, 1955, by Fish and Game Department personnel

UNSPRAYED*			SPRAYED			AREAS CONTAMINATED FROM SPRAY		
Location	No. of live forms	Wt. gms.	Location	No. of live forms	Wt. gms.	Location	No. of live forms	Wt. gms.
Mill Cr.	512	2.9	Yellowstone River			Yellowstone River		
Mission Cr.	434	2.0	Corwin Springs	26	0.5	Carters Bridge	14	0.4
Shields R. #1	625	6.5	Bear Cr.	1	0.0/	Livingston	6	0.3
Shields R. #2	508	4.8	Mcl Heron Cr.	1	0.0/	Above mouth of Shields River	5	0.1
						Big Bend	6	0.3
						Above Big Timber	29	0.5
						Big Timber	22	0.3

* Collections were confined to waters where DDT was not directly applied to the watershed or subject to contamination by drainage from a sprayed watershed.

Table II represents random samples of aquatic insects collected by entomologists of the Agricultural Experiment Station, Montana State College. These samples were taken by collecting the aquatic forms on 20 stones per station within the sprayed area prior to the application of DDT. Additional samples were taken at intervals after the spraying.

Table II. Summary of aquatic insect collections made in Yellowstone Park by personnel from the Agricultural Experiment Station, Montana State College.

Unsprayed drainage			*Prespray			Postspray		
Date	Location	No. of live forms	Date	Location	No. of live forms	Date	Location	No. of live forms
8-30-55	Pebble Creek	120	7-5-55	Upper Tower Creek	155	7-20-55	Upper Tower Creek	7
			7-5-55	Lower Tower Creek	81	8-30-55	Upper Tower Creek	2
			7-12-55	Hellroaring Creek	104	7-20-55	Lower Tower Creek	8
						8-30-55	Lower Tower Creek	1
						7-20-55	Hellroaring Creek	2
						8-29-55	Hellroaring Creek	1

*Collections made one day before aerial application of DDT to the watershed.

On December 13, 1955, a 110 volt DC shocker was used for sampling the remaining fish population in the Gardiner River within the sprayed area. Thirty-six fish were recovered--35 brown trout and 1 rainbow. Stomach samples were taken and analyzed at the Montana State College Fish Laboratory. The main stomach contents were trout eggs. The pyloric caeca regions of the collected stomachs were practically devoid of fatty tissue. During the shocking, dead brown trout were in evidence in the deeper waters.

Summary: A severe fish mortality occurred in the Yellowstone River, beginning approximately October 15, 1955. Reports reaching this office indicate that this mortality is still continuing to persist on the whitefish, brown trout, and suckers. Examination of the dead fish reveals the fish to be in an emaciated condition, resulting from an inadequate food supply. This loss of food is undoubtedly due to the Gardiner Spruce Budworm Control Project, where approximately 133,000 pounds of DDT were used in spraying the drainage this summer. This budworm control project was carried on by the U. S. Forest Service.

Recommendations: Spruce budworm control projects are developing as important conservation measures for our forests. While the value of watershed protection is unquestioned, this report is submitted in the hope that it can stimulate a search for better controls that will do the associated fisheries less harm.

While research has been carried on with hydrocarbons, very little is known about their long-range effects, and additional research is needed to reveal further the residual effects on fish and fish food organisms in streams.

By far the major portion of the research on DDT has been confined to studying its effect on warm water fish in pond habitats. However, in all literature reviewed, extreme caution is advised in the use of DDT

P. F. Elson and C. J. Kerswill report a drastic effect on fish and aquatic insects in the Miramichi River drainage caused by the application of DDT at the rate of one-half pound per acre over one-half of the drainage. (Elson, P. F., and C. J. Kerswill, "Studies on Canadian Atlantic Salmon," Trans. 12th North American Wildlife Conference, pp. 415-426, March 14, 15, & 16, 1955.)

E. W. Surber and A. F. Bartsch report that DDT is so toxic to trout that 3 ounces in a million gallons of water will cause death. (Reprinted by Federal Security Agency, Public Health Service, with permission from Outdoor America, Sept-Oct, 1952)

This mortality in the Yellowstone River drainage represents a substantial loss to the economy of Montana. Evaluations of this fishery in the Missouri River Basin Studies of the U. S. Fish and Wildlife Service, based on figures compiled in 1949 put the net worth of this fishery at \$20,000 per mile annually.

While it is impossible to state what long-range effect this mortality will have on the fishery in the Yellowstone River, it is recommended that studies be inaugurated by the agencies involved to assure that ways and means are found of replacing this fishery.

It is also recommended that a sound research program be established to measure the over-all, long-range effects of pesticides on fish and wildlife and fish food organisms in cold water habitat; and that research be done into the problems of pesticide application in mountainous terrain to develop methods and techniques of application which will be less damaging to aquatic organisms.

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Date December 28, 1955

